

What Is Claimed:

- 1 1. A crystalline silicoaluminophosphate molecular sieve comprising a
2 porous framework structure and a catalytically active integrated hydrocarbon co-
3 catalyst,
4 wherein the silicoaluminophosphate has a catalytic activity index for methanol
5 conversion at 250°C of at least 2.
- 1 2. The crystalline silicoaluminophosphate molecular sieve of claim 1,
2 wherein the silicoaluminophosphate has a catalytic activity index for methanol
3 conversion at 250°C of at least 10.
- 1 3. The crystalline silicoaluminophosphate molecular sieve of claim 1,
2 wherein the catalytically active integrated hydrocarbon co-catalyst is a product of a
3 reaction of any hydrocarbon having a diameter less than a pore-mouth diameter of the
4 crystalline silicoaluminophosphate molecular sieve in contact with the porous
5 framework structure.
- 1 4. The crystalline silicoaluminophosphate molecular sieve of claim 1,
2 wherein the catalytically active integrated hydrocarbon co-catalyst comprises 0.1 to
3 23 weight percent single ring aromatics.
- 1 5. The crystalline silicoaluminophosphate molecular sieve of claim 3,
2 wherein the hydrocarbon comprises an oxygenate.
- 1 6. The crystalline silicoaluminophosphate molecular sieve of claim 1,
2 wherein the catalytically active integrated hydrocarbon co-catalyst remains active
3 even after being exposed to air at room temperature for 12 hours or after being
4 subjected to heating at 450°C for 0.5 hour.
- 1 7. The crystalline silicoaluminophosphate molecular sieve of claim 1,
2 wherein the silicoaluminophosphate molecular sieve is selected from the group
3 consisting of SAPO-5, SAPO-8, SAPO-11, SAPO-16, SAPO-17, SAPO-18, SAPO-
4 20, SAPO-31, SAPO-34, SAPO-35, SAPO-36, SAPO-37, SAPO-40, SAPO-41,

5 SAPO-42, SAPO-44, SAPO-47, SAPO-56, the metal containing forms thereof, and
6 mixtures thereof.

1 8. The crystalline silicoaluminophosphate molecular sieve of claim 7,
2 wherein the silicoaluminophosphate molecular sieve is SAPO-34.

1 9. A catalyst for converting an oxygenate feedstock to an olefin product,
2 comprising a crystalline silicoaluminophosphate molecular sieve having a porous
3 framework structure, and a binder, wherein the porous framework structure contains
4 an active integrated hydrocarbon co-catalyst,
5 wherein the silicoaluminophosphate has a catalytic activity index for methanol
6 conversion at 250°C of at least 2.

1 10. The catalyst of claim 9, wherein the silicoaluminophosphate has a
2 catalytic activity index for methanol conversion at 250°C of at least 10.

1 11. The catalyst of claim 9, wherein the catalytically active integrated
2 hydrocarbon co-catalyst is a product of a reaction of any hydrocarbon having a
3 diameter less than a pore-mouth diameter of the crystalline silicoaluminophosphate
4 molecular sieve in contact with the porous framework structure.

1 12. The catalyst of claim 9, wherein the catalytically active integrated
2 hydrocarbon co-catalyst comprises 0.1 to 23 weight percent single ring aromatics.

1 13. The catalyst of claim 11, wherein the hydrocarbon comprises an
2 oxygenate.

1 14. The catalyst of claim 9, wherein the catalytically active integrated
2 hydrocarbon co-catalyst remains active even after being exposed to air at room
3 temperature for 12 hours or after being subjected to heating at 450°C for 0.5 hour.

1 15. The catalyst of claim 9, wherein the silicoaluminophosphate molecular
2 sieve is selected from the group consisting of SAPO-5, SAPO-8, SAPO-11, SAPO-
3 16, SAPO-17, SAPO-18, SAPO-20, SAPO-31, SAPO-34, SAPO-35, SAPO-36,

4 SAPO-37, SAPO-40, SAPO-41, SAPO-42, SAPO-44, SAPO-47, SAPO-56, the metal
5 containing forms thereof, and mixtures thereof.

1 16. The catalyst of claim 15, wherein the silicoaluminophosphate
2 molecular sieve is SAPO-34.

1 17. A method of making an olefin product from an oxygenate feedstock,
2 comprising:

3 contacting a silicoaluminophosphate molecular sieve having a porous
4 framework structure with a hydrocarbon at conditions effective to form at least a
5 integrated hydrocarbon co-catalyst within the porous framework, and

6 contacting the silicoaluminophosphate molecular sieve containing the
7 integrated hydrocarbon co-catalyst with an oxygenate feedstock under conditions
8 effective to convert the feedstock to the olefin product,

9 wherein the silicoaluminophosphate has a catalytic activity index for methanol
10 conversion at 250°C of at least 2.

1 18. The method of claim 17, wherein the silicoaluminophosphate has a
2 catalytic activity index for methanol conversion at 250°C of at least 10.

1 19. The method of claim 17, wherein the catalytically active integrated
2 hydrocarbon co-catalyst is a product of a reaction of any hydrocarbon having a
3 diameter less than a pore-mouth diameter of the crystalline silicoaluminophosphate
4 molecular sieve in contact with the porous framework structure.

1 20. The method of claim 17, wherein the catalytically active integrated
2 hydrocarbon co-catalyst comprises 0.1 to 23 weight percent single ring aromatics.

1 21. The method of claim 19, wherein the hydrocarbon comprises an
2 oxygenate.

1 22. The method of claim 17, wherein the catalytically active integrated
2 hydrocarbon co-catalyst is remains active even after being exposed to air at room
3 temperature for 12 hours or after being subjected to heating at 450°C for 0.5 hour.

1 23. The method of claim 17, wherein the silicoaluminophosphate
2 molecular sieve is selected from the group consisting of SAPO-5, SAPO-8, SAPO-11,
3 SAPO-16, SAPO-17, SAPO-18, SAPO-20, SAPO-31, SAPO-34, SAPO-35, SAPO-
4 36, SAPO-37, SAPO-40, SAPO-41, SAPO-42, SAPO-44, SAPO-47, SAPO-56, the
5 metal containing forms thereof, and mixtures thereof.

1 24. The catalyst of claim 23, wherein the silicoaluminophosphate
2 molecular sieve is SAPO-34.

1 25. An olefin product made according to the method of claim 17.

1 26. The olefin product of claim 25 comprising ethylene and propylene.

1 27. A method of making a polyolefin from an oxygenate feedstock,
2 comprising:
3 contacting a silicoaluminophosphate molecular sieve having a porous
4 framework structure with a hydrocarbon at conditions effective to form at least a
5 integrated hydrocarbon co-catalyst within the porous framework,
6 contacting the silicoaluminophosphate molecular sieve containing the
7 integrated hydrocarbon co-catalyst with an oxygenate feedstock under conditions
8 effective to convert the feedstock to an olefin product, and
9 contacting the olefin product with a polyolefin-forming catalyst under
10 conditions effective to form the polyolefin,
11 wherein the silicoaluminophosphate containing the integrated hydrocarbon co-
12 catalyst has a catalytic activity index for methanol conversion at 250°C of at least 2.

1 28. A polyolefin made by the process of claim 27.

1 29. The polyolefin of claim 28 comprising polyethylene.

1 30. The polyolefin of claim 28 comprising polypropylene.

1 31. A crystalline silicoaluminophosphate molecular sieve comprising a
2 porous framework structure and a catalytically active integrated hydrocarbon co-
3 catalyst,

4 wherein the catalytically active integrated hydrocarbon co-catalyst is a product
5 of a reaction of a hydrocarbon in contact with the porous framework.

1 32. The crystalline silicoaluminophosphate molecular sieve of claim 31,
2 wherein the hydrocarbon comprises an oxygenate.

1 33. The crystalline silicoaluminophosphate molecular sieve of claim 31,
2 wherein the catalytically active integrated hydrocarbon co-catalyst comprises 0.1 to
3 23 weight percent single ring aromatics.

1 34. The crystalline silicoaluminophosphate molecular sieve of claim 31,
2 wherein the catalytically active integrated hydrocarbon co-catalyst is remains active
3 even after being exposed to air at room temperature for 12 hours or after being
4 subjected to heating at 450°C for 0.5 hour.

1 35. The crystalline silicoaluminophosphate molecular sieve of claim 31,
2 wherein the silicoaluminophosphate molecular sieve is selected from the group
3 consisting of SAPO-5, SAPO-8, SAPO-11, SAPO-16, SAPO-17, SAPO-18, SAPO-
4 20, SAPO-31, SAPO-34, SAPO-35, SAPO-36, SAPO-37, SAPO-40, SAPO-41,
5 SAPO-42, SAPO-44, SAPO-47, SAPO-56, the metal containing forms thereof, and
6 mixtures thereof.

1 36. The crystalline silicoaluminophosphate molecular sieve of claim 35,
2 wherein the silicoaluminophosphate molecular sieve is SAPO-34.

1 37. A method of making an integrated hydrocarbon co-catalyst,
2 comprising:
3 preparing an silicoaluminophosphate molecular sieve having a porous
4 framework structure and
5 contacting said silicoaluminophosphate with a hydrocarbon at conditions
6 effective to form at least said integrated hydrocarbon co-catalyst within the porous
7 framework,

8 wherein said the silicoaluminophosphate comprising said integrated
9 hydrocarbon co-catalyst has a catalytic activity index for methanol conversion at
10 250°C of at least 2.

1 38. The method of claim 37, wherein said conditions effective to form at
2 least said integrated hydrocarbon co-catalyst comprises contacting a hydrocarbon
3 having a diameter less than a pore-mouth diameter of the crystalline
4 silicoaluminophosphate molecular sieve.

1 39. The method of claim 38, wherein said contacting comprises first
2 contacting at a lower temperature and second contacting at a higher temperature.

1 40. The method of claims 39, wherein a difference between said higher
2 temperature and said lower temperature is at least 10°C.

1 41. The method of claims 39, wherein a difference between said higher
2 temperature and said lower temperature is at least 25°C.

1 42. The method of claims 39, wherein the hydrocarbon contacted in said
2 first contacting is different from that contacted in said second contacting.

1 43. The method of claims 42, wherein a difference between said higher
2 temperature and said lower temperature is at least 10°C.

1 44. The method of claims 42, wherein a difference between said higher
2 temperature and said lower temperature is at least 25°C.

1 45. The method of claim 37, wherein the silicoaluminophosphate has a
2 catalytic activity index for methanol conversion at 250°C of at least 10.

1 46. The method of claim 37, wherein the catalytically active integrated
2 hydrocarbon co-catalyst comprises 0.1 to 23 weight percent single ring aromatics.

1 47. The method of claim 37, wherein the hydrocarbon comprises an
2 oxygenate.

1 48. The method of claim 37, wherein the catalytically active integrated
2 hydrocarbon co-catalyst is remains active even after being exposed to air at room
3 temperature for 12 hours or after being subjected to heating at 450°C for 0.5 hour.

1 49. The method of claim 37, wherein the silicoaluminophosphate
2 molecular sieve is selected from the group consisting of SAPO-5, SAPO-8, SAPO-11,
3 SAPO-16, SAPO-17, SAPO-18, SAPO-20, SAPO-31, SAPO-34, SAPO-35, SAPO-
4 36, SAPO-37, SAPO-40, SAPO-41, SAPO-42, SAPO-44, SAPO-47, SAPO-56, the
5 metal containing forms thereof, and mixtures thereof.

1 50. The catalyst of claim 49, wherein the silicoaluminophosphate
2 molecular sieve is SAPO-34.